FOR ENTERPRISE ARCHITECTURE PROFESSIONALS

The Anatomy Of A System Of Insight

Understand How Systems Of Insight Turn Data Into Action

by Brian Hopkins, Michele Goetz, and Noel Yuhanna
March 22, 2017

Why Read This Report

Your big data strategy is likely too little, too late. Customers are changing their expectations too quickly, and data lakes are becoming swamps. Insights-driven disruptors are using systems of insight to steal revenue from competitors and grow year-over-year at a double-digit pace. This report breaks down the components of a system of insight into a reference architecture and provides examples so enterprise architects can start helping their firms build them.

Key Takeaways

Systems Of Insight Are Different
Systems of insight are not another term for today's business intelligence (BI) or advanced analytics. They include people, process, and technology that close the loop between data, digital insight, and action through software.

Systems Of Insight Have Five Components
Systems of insight are built by connecting five components in a closed loop: instrumented applications, a data flow pipeline, an analytic compute engine, an insight-to-execution framework, and a big data fabric foundation. Insight teams add analytic support tooling to develop, test, and deploy insight or insight-producing software, then they monitor, learn, and optimize actions.

Use A Digital Insights Architecture To Connect Systems Of Insight
You will want to build many systems of insight to drive outcomes within and across customer life-cycle stages. Insight platforms provide the technology that a set of related systems need; plan on having three to six of them. Lastly, connect platforms and the systems they support to a big data fabric.

The Anatomy Of A System Of Insight

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Insights-Driven Businesses Build Systems Of Insight

Forrester has identified a new class of digital predator that has evolved from the likes of Facebook, LinkedIn, and Netflix: the insights-driven business. These firms do not pursue big data strategies and build data lakes. Instead, they have mutated DNA — enterprise architects need to be aware that they are built differently, so they can operate differently to systematically engage customers and reduce overhead.[1] How? While insights-driven businesses often use big data and advanced analytics such as AI, they drive action and outcomes with systems of insight.

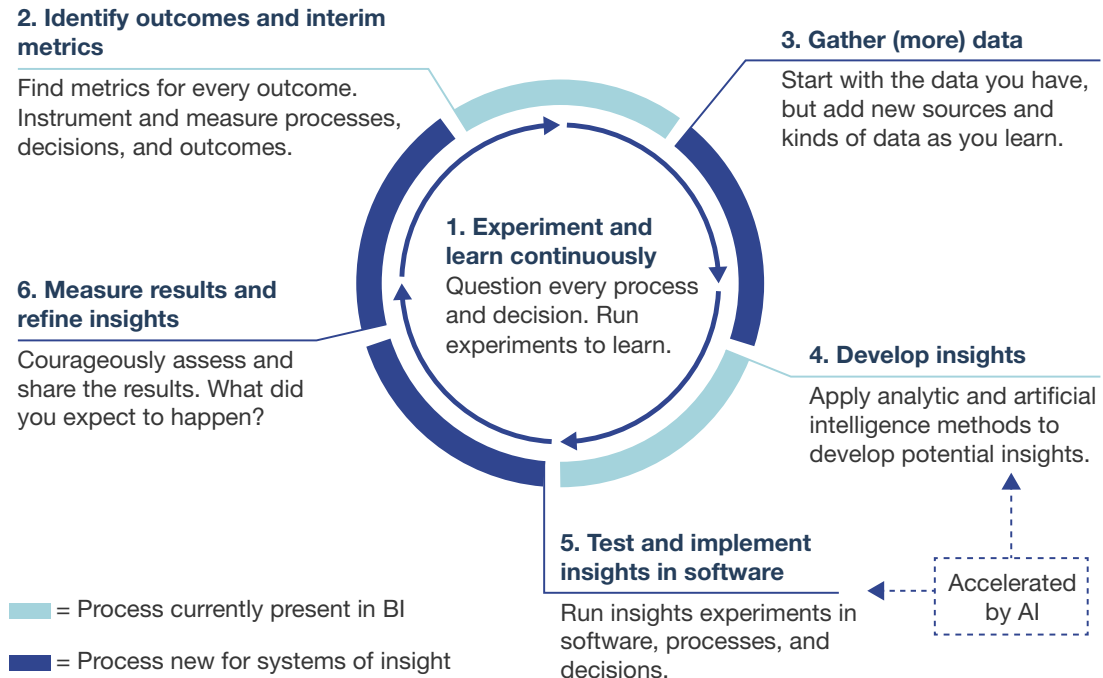### Systems Of Insight Are Different From Other Big Data Analytics

"Systems of insight" is not just a new way to say BI or big data analytics. Rather, it's an evolution of these (see Figure 1). A system of insight is the business discipline and technology to harness digital insights — new, actionable knowledge that can be implemented in software — and apply these insights consistently to turn data into action.[2] Systems of insight:

› **Operate through the actions of agile, cross-functional insight teams.** Analytics or BI centers of excellence do projects like building reports or embedding a visualization in applications like Salesforce, but they do not own the entire loop.[3] Systems of insight are operated by small, cross-functional insight teams that do own the loop.[4] These teams include data scientists, developers, data engineers, software developers, and business experts. They work in an agile, "InsightOps" style to source data, develop insight, and test it in analytics applications.

› **Close the loop between action, insight, and data for a specific, priority outcome.** A system of insight starts with actions that drive high-priority outcomes such as customer retention. Insight teams develop digital insights — perhaps churn predictions — and harness employee knowledge such as customer satisfaction. The systems test and implement these digital insights in software (in this case, marketing campaign management tools) to change actions, such as making contextual offers. Lastly, the system measures outcomes by capturing data as a source of learning, using the trail of breadcrumbs left by systems of engagement such as mobile behavior and transaction logs.[5]

› **Collect big data as part of the insight-to-execution process.** Systems of insight employ an insight-to-execution operating model to continuously iterate around the loop, starting with analytics on data they already have. The process includes testing hypotheses and then adding in more data and new analytics as part of continuous improvement. For example, Alaska Airlines built a system of insight to optimize its on-time performance, but it eventually instrumented aircraft doors to capture data about when planes were ready to take off.[6]

FIGURE 1 Systems Of Insight Close The Data-Insight-Action Loop

2. Identify outcomes and interim metrics

Find metrics for every outcome. Instrument and measure processes, decisions, and outcomes.

3. Gather (more) data

Start with the data you have, but add new sources and kinds of data as you learn.

1. Experiment and learn continuously
Question every process and decision. Run experiments to learn.

6. Measure results and refine insights

Courageously assess and share the results. What did you expect to happen?

4. Develop insights

Apply analytic and artificial intelligence methods to develop potential insights.

5. Test and implement insights in software

Run insights experiments in software, processes, and decisions.

Accelerated by AI

= Process currently present in BI

= Process new for systems of insight

The Anatomy Of A System Of Insight

Your firm has likely built a few systems of insight already, though you likely have not labeled them as such. For example, digital marketers create systems of insight to test and optimize digital experiences using A/B or multivariate testing. They measure visitor reaction and then optimize offers and campaigns based on insights. The systems-of-insight approach extends this way of working into many areas of your business, such as call centers or product development.

Systems of insight are frequently built upon tried-and-true analytics architectures featuring things like predictive analytics, and agile BI, and thus they are not "all new." They do, however, feature five elements connected in a specific way; this makes them new in a holistic sense (see Figure 2):

1. **Instrumented applications that implement insights and measure outcomes.** Systems of insight always include the applications, systems, or devices that implement insight and drive user action. They also include a means to measure outcomes and capture associated data. Developers on insights teams need to instrument software or devices to collect the right data in the right way.[7] For example, Earnest, a financial technology startup, instrumented its loan origination system to collect fine-grained underwriter behavior to improve loan pricing models.
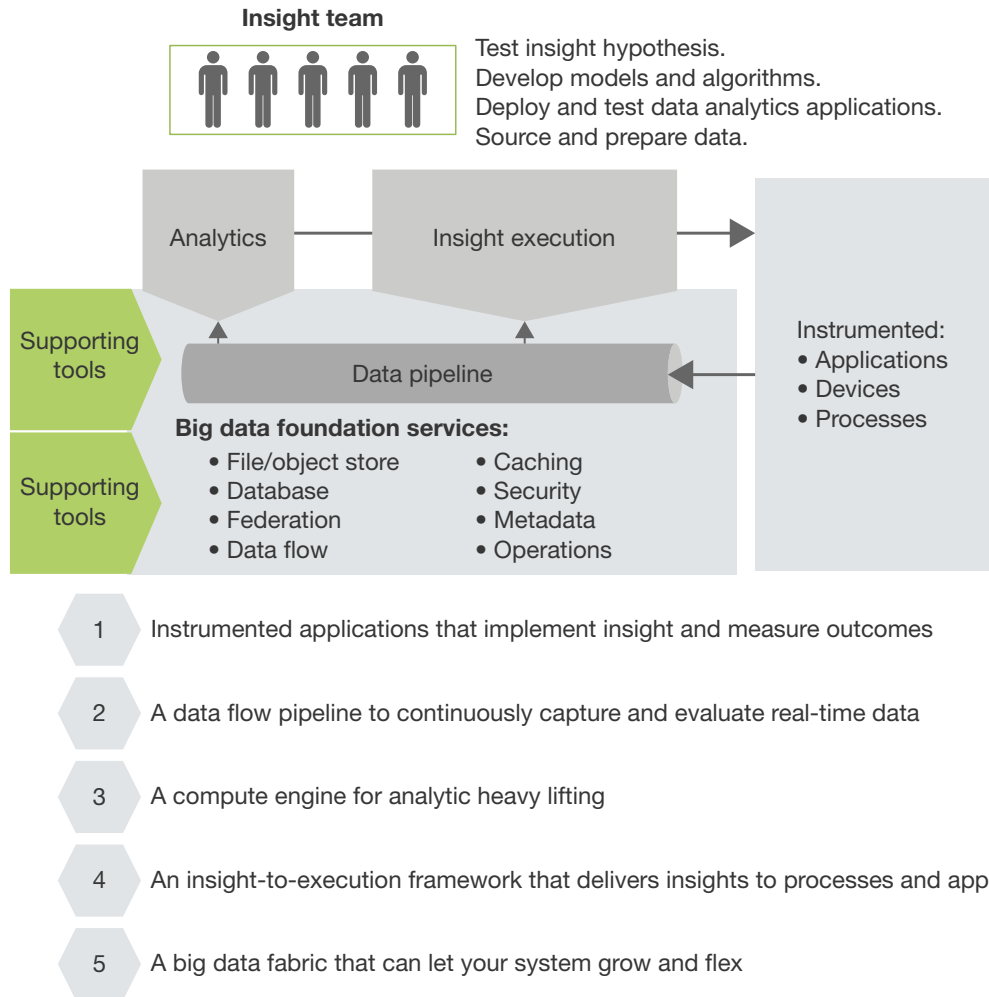
2. **A data flow pipeline to continuously capture and evaluate real-time data.** Systems of insight have a pipeline to tap more and more data from the flow from instrumented software, devices, and external services. Technologies include data flow tools like Hortonworks DataFlow, high-performance messaging tools like Apache Kafka, and possibly big data-enabled integration tools from IBM or Informatica. Don't think of this as just a data pipeline, however — you must also include tools to examine flows and learn how insights are performing in real time, such as SAS's Visual Investigator.

3. **A compute engine for analytic heavy lifting.** Systems of insight include technology that can run analytic computations — for example, TIBCO Enterprise Runtime for R (TERR). Teradata has similar capabilities, but they are built into its database. Cognitive search tools like Franz's AllegroGraph serve a similar purpose; however, these tools often use machine learning or AI internally to surface insights and store them in a graph database.

4. **An insight-to-execution framework that delivers insights to action.** Insight execution technology delivers insights to applications. For example, Pivotal's Spring Cloud Data Flow and SAS Event Stream Processing allow developers to create sophisticated event-based workflows that source data, prepare it, do computations, and expose resulting insights to applications like call centers or CRM systems. TIBCO's business rules and business events software serve similar insight execution functions.

5. **A big data fabric that can let your system grow and flex.** The data in your systems of insight will naturally grow over time, so you need a scalable and elastic data foundation. For example, once you optimize marketing campaigns for new micro segments gleaned from customer online behavior, how about optimizing for the impact of weather insight services from IBM/The Weather Company? Your platform must be both scalable and elastic, because getting a system of insight right can take a lot of experimentation.[8]

FIGURE 2 Systems Of Insight Have Five Common Elements

Insight team

Test insight hypothesis.
Develop models and algorithms.
Deploy and test data analytics applications.
Source and prepare data.

Analytics

Insight execution

Supporting tools

Data pipeline

Instrumented:
• Applications
• Devices
• Processes

Supporting tools

Big data foundation services:
• File/object store
• Database
• Federation
• Data flow
• Caching
• Security
• Metadata
• Operations

1   Instrumented applications that implement insight and measure outcomes

2   A data flow pipeline to continuously capture and evaluate real-time data

3   A compute engine for analytic heavy lifting

4   An insight-to-execution framework that delivers insights to processes and applications

5   A big data fabric that can let your system grow and flex

Examples Will Train Your System-Of-Insight Muscles

Enterprise architects can prepare to evolve their big data analytics solutions into systems of insight by selecting examples from their organization that are close to systems of insight already, then creating new architecture views that call out the five elements. We present two examples taken from client interactions and common big data analytics solutions: customer retention and predictive maintenance.

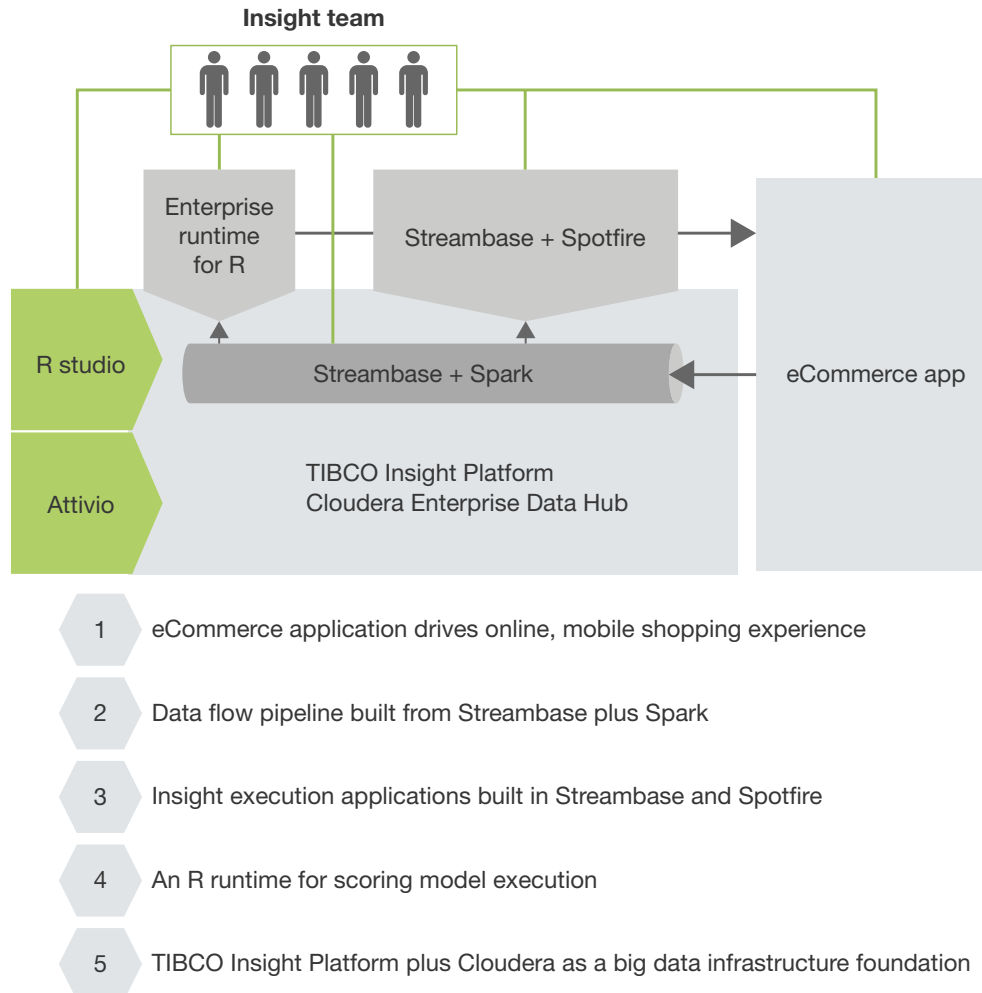### Example No. 1: Optimize Digital Customer Experiences

A retail eBusiness marketing organization wanted to make product recommendations to its visitors using mobile and web behavior data in real time. It had been batch-loading data into a digital agency partner's cloud service then waiting a half hour or more for the partner's recommendation API to update. This process was slow, the insights were not contextual, and the organization lacked control of its data.

The firm implemented a system of insight to optimize eCommerce systems' configuration settings like rule confidence and lift, targeting an increased average basket size as the primary outcome. Its insight team consisted of digital marketers, eBusiness analysts, eCommerce developers, data scientists, and data engineers from technology management. It used TIBCO's Insight Platform and Cloudera to build an insight platform that hosted its system (see Figure 3).[9] Its insight team:

› **Built a closed loop between digital properties, predictive analytics, and real-time data.** The solution streams online behavior and combines it with transaction history, social sentiment, and product catalog data. A StreamBase insight-to-execution application calls TIBCO TERR to execute algorithms, developed by data scientists. The resulting insights are stored in a cache, where the eCommerce platform can call them by using an API. Mobile and web servers are instrumented to collect customer behavior data, which the system feeds back to the pipeline for future learning.

› **Used supporting predictive and text analytics plus data cataloging tools.** The firm's data scientists develop R algorithms; however, developers had to extensively test their models to ensure they performed correctly in TERR, which supports a limited set of R algorithms at scale.[10] Analysts and data scientists also performed text analytics of big social media content as well as cataloging it using Attivio, part of TIBCO's insight platform.

› **Operated in an agile way to continuously test, learn, and optimize.** By using a data pipeline along with model runtime and insight execution tools from a single vendor, the firm's platform was easier to manage. It also provided a common framework for developers and data scientists to use as they measured, learned, experimented, and optimized models and their insight application. Attivio's data cataloging and collaboration features helped the team work together as it sourced data, defined data, and experimented with its use.

FIGURE 3 An eCommerce System Of Insight Built Using TIBCO's Insight Platform Suite

1 eCommerce application drives online, mobile shopping experience

2 Data flow pipeline built from Streambase plus Spark

3 Insight execution applications built in Streambase and Spotfire

4 An R runtime for scoring model execution

5 TIBCO Insight Platform plus Cloudera as a big data infrastructure foundation

Example No. 2: Reduce Equipment Operating Costs

A heavy equipment manufacturer is transitioning from a one-time sales model to a recurring revenue business model. Because operating costs now directly affect profitability, it needed to operate as efficiently as possible by tuning equipment parameters and ensuring replacement parts were efficiently available.

Traditionally, firms meet these objectives with separate solutions. Instead, this firm decided to build a single system of insight focused on reducing total lifetime operational costs. Its insight team consists of product engineers, equipment operators, data scientists, and data engineers from technology management. The team uses SAS's insight platform suite and SAS's predictive maintenance solution as an insight platform (see Figure 4).[11] The manufacturer's insight team:
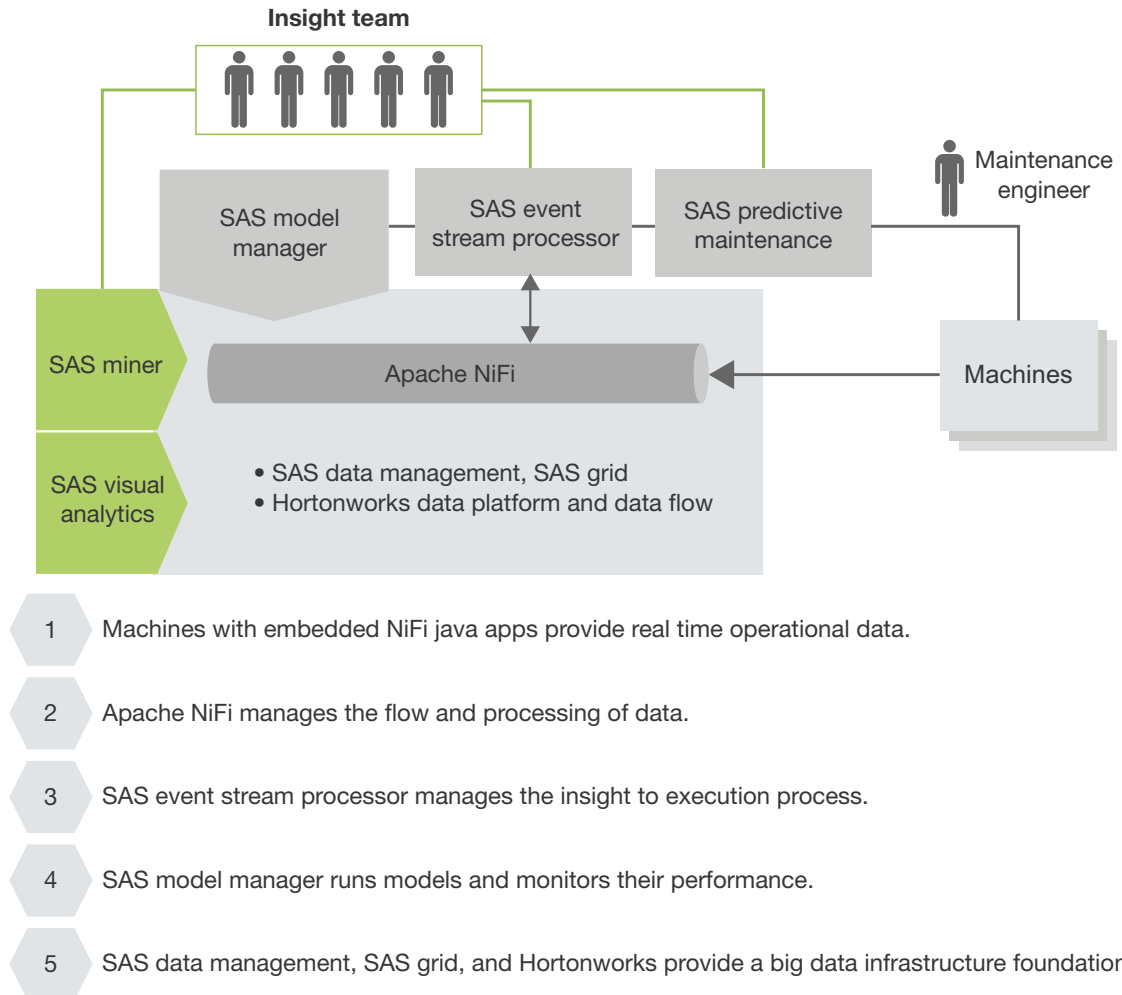
› **Defined a closed loop between machines, predictive maintenance, and data.** The team built an Apache NiFi pipeline to handle data flow from devices, edge servers, and data analytics in its data centers. The pipeline hands off processed data to SAS Event Stream Processing (ESP), which manages execution of algorithms and passes the results to SAS's predictive maintenance solution and ERP.[12] The predictive maintenance application advises equipment operators and maintenance engineers. The actions they take change equipment operating data, which the system captures back into the pipeline.

› **Uses supporting visual analytics and predictive modeling tools.** SAS Factory Miner tests models against data and selects the most predictive ones, then it deploys them to Model Manager, which automates scoring. Equipment engineers used SAS Visual Analytics for self-service data preparation, often calling model outputs to examine real-time data streams. They learn how model predictions are working and recommend model tuning to data scientists.

› **Operates in an agile way to continuously test and learn.** The full stack of insight platform tools from SAS provides a unified platform for data management, predictive and visual analytics, and insight execution. This helps data scientists, product engineers, and data engineers collaborate, optimize and redeploy models, and change predictive maintenance application parameters easier and more quickly.

FIGURE 4 A Predictive Maintenance System Of Insight Built Using SAS's Insight Platform Suite

1. Machines with embedded NiFi java apps provide real time operational data.

2. Apache NiFi manages the flow and processing of data.

3. SAS event stream processor manages the insight to execution process.

4. SAS model manager runs models and monitors their performance.

5. SAS data management, SAS grid, and Hortonworks provide a big data infrastructure foundation.

Recommendations

Make Systems Of Insight Part Of Your Digital Insights Architecture

As your organization matures, you will find more and more opportunities to share data and insights across organizational boundaries. For example, Zion Bank invested in big data and advanced analytics to serve security and risk solutions, but it quickly expanded the effort to include marketing because it found that marketers and risk managers needed not only data but also customer insight.

How can enterprise architects support a growing inventory of different systems of insight? Establish them as one part of a broader digital insights architecture by planning to build and operate (see Figure 5):
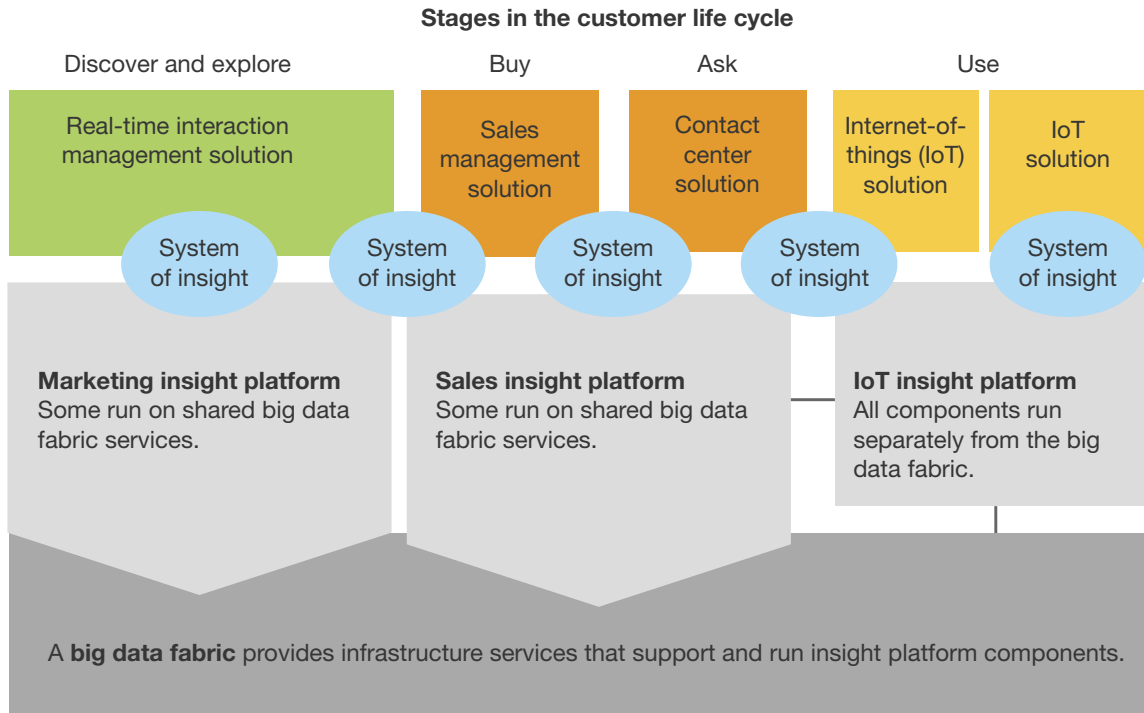
> **Systems of insight that connect across customer life-cycle states.** Add a system-of-insight artifact to your reference architecture library, then plan to evolve your existing BI and advanced analytics solutions by closing the loop. Use the customer life cycle to plan systems that will drive high-priority outcomes across systems of engagement, record, and automation.[13] Some systems of insight should connect across life-cycle states. For example, a system of customer sentiment insight might serve both a mobile marketing system of engagement and a sales management system of record.

> **Strategic insight platforms that support systems-of-insight applications.** Insight platforms unify the systems-of-insight technology.[14] You will ultimately need three to six strategic insight platforms because the different parts of your business have different needs and are comfortable with different vendors. Don't drive standards; provide flexibility. For example, marketers may want a platform built on Manthan's Customer 360 and TargetOne, while supply chain operations may want to use a platform suite from SAP or Teradata.[15]

> **A big data fabric that connects insight platforms.** Big data fabrics bring together disparate big data sources automatically, intelligently, and securely. They process data using scalable big data technologies like Hadoop, Spark, or cloud technologies and deliver a unified, trusted, and comprehensive view of customer and business data.[16] Plan to evolve your big data lake into a fabric over time by adding services like in-memory caching, data virtualization, or metadata cataloging. Plan to attract insight platform and systems-of-insight owners by demonstrating benefits when they build their system on your fabric or plug into it.

FIGURE 5 Systems Of Insight And Insight Platforms Glue Together Customer Life-Cycle Applications

Stages in the customer life cycle

Discover and explore | Buy | Ask | Use

Real-time interaction management solution

Sales management solution

Contact center solution

Internet-of-things (IoT) solution

IoT solution

System of insight

System of insight

System of insight

System of insight

System of insight

Marketing insight platform
Some run on shared big data fabric services.

Sales insight platform
Some run on shared big data fabric services.

IoT insight platform
All components run separately from the big data fabric.

A **big data fabric** provides infrastructure services that support and run insight platform components.

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MapR Technologies	Teradata
Morningstar	TIAA-CREF
Nordstrom	TIBCO Software
Oracle	Warner Bros. Entertainment
Pivotal Software	The Washington Post
The Pythian Group	

Endnotes

[1] By 2020, insights-driven business will steal $1.2 trillion a year in revenue from competitors that are not insights-driven. See the Forrester report "The Insights-Driven Business."

[2] Forrester defines systems of insight as "the business discipline and technology to harness insights and consistently turn data into action." See the Forrester report "Digital Insights Are The New Currency Of Business."

[3] See the Forrester report "Build An Agile BI Organization."

[4] An insight team may operate as a single dedicated team or be a matrixed team, where members cross between organizational boundaries. There are many options, but the key is that team members have different functions — data science, app development, data engineering — and, as such, they own a systems-of-insight loop from end-to-end.

[5] See the Forrester report "Digital Insights Are The New Currency Of Business."

[6] See the Forrester report "The Insights-Driven Business."

[7] In some cases, the instrumentation is simple — just configure an application to record to a log file. Others require firmware or hardware design choices, such as installing a sensor to modify the data stream a sensor produces.

[8] This is the problem with the one-premise data lake concept: It was designed to easily scale out data and compute capacity, but it's limited by network capacity. Nor can it scale in or add new technologies to the stack (or discard them). An elastic big data foundation will help EA pros discard data and technology that they find they no longer need.

[9] TIBCO Insight Platform is a software product name. Forrester defines insight platforms as follows: "Insight platforms unify the technologies to manage and analyze data, test and integrate the derived insights into business action, and capture feedback for continuous improvement." See the Forrester report "Insight Platforms Accelerate Digital Transformation" and see the Forrester report "Vendor Landscape: Insights Platforms, Q3 2016."

10 We have purposefully skipped over a lot of detail that you will have to work out. For example: 1) At what stage does the insights team need to do the "extensive testing" of the models, and does it require retesting at intervals? 2) Since social media content has a short shelf life as an input to a model, how much should you keep?

11 See the upcoming Forrester report "Embedded Business Intelligence In Systems Of Insight."

12 ERP: enterprise resource planning.

13 See the Forrester report "The Customer Life Cycle: A Blueprint For Customer-Obsessed Enterprises."

14 See the Forrester report "Insight Platforms Accelerate Digital Transformation."

15 Forrester defines an enterprise insight platform suite as "integrated or partially integrated suites of data management, analytics, and insight execution components that require some integration and configuration to form a platform." See the Forrester report "The Forrester Wave™: Enterprise Insight Platform Suites, Q4 2016."

16 See the Forrester report "Big Data Fabric Drives Innovation And Growth."

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